CLAIMS

1. A method of depositing material on a substrate, comprising the steps of:

delivering from an outlet a stream of droplets of a precursor liquid towards a substrate;

applying an electric field between the outlet and the substrate; and

generating a flame between the outlet and the substrate such that at least a portion of the stream of droplets of the precursor liquid passes through the flame before reaching the substrate and the precursor liquid is chemically reacted and/or decomposed to provide the deposited material.

2. The method according to claim 1, wherein the flame generation step comprises the step of delivering from a second outlet an annular flow of fuel about the stream of droplets such as to provide an annular flame combustion region through which at least the portion of the stream of droplets passes before reaching the substrate.

3. The method according to claim 2, wherein the annular flow of fuel is a diverging flow.

4. The method according to claim 2 ~~or 3~~, wherein the first and second outlets are coaxial.

5. The method according to claim 1 ~~any of claims 1 to 4~~, wherein the stream of droplets is provided as a diverging spray.

6. The method according to claim 1 ~~any of claims 1 to 5~~, further comprising the step of delivering a flow of cold gas in the direction from the ~~first~~ outlet towards the substrate.

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7. The method according to claim 6 when appendant upon claim 2, wherein the flow of cold gas is delivered from a third outlet as an annular flow about the stream of droplets and within the annular flow of fuel.

8. The method according to claim 7, wherein the first and third outlets are coaxial.

9. The method according to ~~any of claims 1 to 8~~ claim 1, wherein the material is a ceramic material.

10. The method according to ~~any of claims 1 to 9~~ claim 1, wherein the material is a multicomponent oxide material.

11. The method according to ~~any of claims 1 to 10~~ claim 1, further comprising the step of heating the substrate.

12. The method according to ~~any of claims 1 to 11~~ claim 1, wherein the precursor liquid is a sol precursor solution.

13. The method according to ~~any of claims 1 to 12~~ claim 1, further comprising the step of moving one or both of the substrate and the first outlet during deposition so as to deposit a three-dimensional structure as a series of overlying layers.

14. The method according to ~~any of claims 1 to 13~~ claim 1, further comprising the step of controlling the region of deposition by varying one or more of the rate of flow of the fuel, the separation between the first outlet and the substrate and the electric field between the first outlet and the substrate.

15. The method according to ~~any of claims 1 to 14~~ claim 1, wherein the material is deposited as a powder and the chemical reaction and/or decomposition occurs away from the substrate.

16. The method according to ~~any of claims 1 to 14~~ claim 1, wherein the material is deposited as a solid film and the chemical reaction and/or decomposition occurs in the vicinity of the substrate.

17. An apparatus for depositing material on a substrate, comprising:
a substrate holder for holding a substrate;
a nozzle assembly including an outlet from which a stream of droplets of a precursor liquid is in use delivered to a substrate;
a precursor supply for supplying a precursor liquid to the nozzle assembly;
an electrical supply for applying an electric field between the outlet and the substrate; and
a burner for generating a flame between the outlet and the substrate and being configured such that in use at least a portion of the stream of droplets of the precursor liquid passes through the flame before reaching the substrate and the precursor liquid is chemically reacted and/or decomposed to provide the deposited material.

18. The apparatus according to claim 17, wherein the burner is provided by the nozzle assembly and the nozzle assembly includes a second outlet from which an annular flow of fuel is in use delivered such as to provide an annular flame combustion region through which at least the portion of the stream of droplets passes before reaching the substrate, and further comprising a fuel supply for supplying fuel to the nozzle assembly.

19. The apparatus according to claim 18, wherein the first and second outlets are coaxial.

20. The apparatus according to claim 18 ~~or 19~~, wherein the nozzle assembly further comprises a third outlet disposed between the first and second outlets from which an annular flow of cold gas is in use delivered.

21. The apparatus according to claim 20, wherein the first and third outlets are coaxial.

22. The apparatus according to ~~any of claims 18 to 21~~ claim 18, wherein the first outlet is a central outlet.

23. The apparatus according to ~~any of claims 17 to 22~~ claim 17, further comprising a mesh disposed between the first outlet and the substrate.

24. The apparatus according to ~~any of claims 17 to 23~~ claim 17, further comprising an electrode at an electric potential between the potential of the first outlet and the substrate and disposed between the first outlet and the substrate.

25. The apparatus according to claim 24, wherein the electrode is an annular electrode.

26. The apparatus according to ~~any of claims 17 to 25~~ claim 17, further comprising a positioner for altering the relative position of the first outlet and the substrate.

27. The apparatus according to ~~any of claims 17 to 26~~ claim 17, where configured such that the chemical reaction and/or decomposition occurs away from the substrate so as to provide the material as a powder.

28. The method according to ~~any of claims 17 to 26~~ claim 17, where configured such that the chemical reaction and/or decomposition occurs in the vicinity of the substrate so as to provide the material as a solid film.

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